

108 Technology and the Life Sciences



Scientific discoveries can lead to new inventions, or technologies. As new inventions are used and improved, they often lead to the study and discovery of new science principles. For example, the scientific discovery that glass lenses can be used to magnify objects led to the invention of eyeglasses and telescopes. Telescopes were then used to discover distant planets and stars.

Science and technology are closely related and depend on each other, but they also have distinctive characteristics. Just as there are many kinds of science, there are many fields of study that involve inventions, such as industrial technology, computer technology, and biotechnology. Inventions are designed and built by engineers, scientists, doctors, and a variety of people trying to solve everyday problems.



How are science and technology linked and how are they different?

MATERIALS



For each student

- 1 Student Sheet 108.1, "Connections Between Science and Technology"



These high school students are using both tools and ideas to perform a science lab activity.

PROCEDURE


Part A: Scientists and Inventors


1. As directed by your teacher, read the descriptions on the following pages of the work of 16 people.
2. In your group of four, decide whether you would describe each person as more of a scientist, an inventor, or a combination of the two.
3. In your notebook list the people you consider to be bioengineers. Explain.

Part B: Science and Inventions

4. In your group of four, think about the science concepts listed in the center column, Rows 1–3, on Student Sheet 108.1, “Connections Between Science and Technology.” In the left-hand column, record any inventions you think have helped to explore these science concepts.
5. Discuss inventions that you think were developed at least partly as a result of the science concepts listed. Record your ideas in the right-hand column.
6. Think of at least two more science concepts that you have studied. Write each in a row of the center column. Try to fill in the left-hand column and the right-hand column as you did in Rows 1–3.
7. **a.** Think of an invention you use in your life. Record this invention in the right-hand column. Think about a science concept that was necessary to understand in order to invent it. Write the science concept in the center column. Try to express the concept in a complete sentence.
b. Then think about what inventions helped to make the discovery of the science concept possible. Write your ideas in the left-hand column.

ANALYSIS

1. How would you describe the relationship between science and technology? Describe one example from this activity or from your science course that illustrates this relationship.
-  2. Think about a career that interests you. All careers can benefit from scientific thinking and inventions. Many careers also require some science knowledge. How might your inventing skills and understanding of science help you succeed in your chosen career?

-  3. Imagine that you could decide how much money a university will provide for scientific research and how much it will provide for development of technology. The university is considering two proposals. One proposal would provide 80% of the funds to scientific research and 20% to technology development. The other proposal would split the funding so that 20% goes to scientific research and 80% goes to technology development.

Explain whether you would fund one of these two proposals, or whether you would make another proposal. If you would make another proposal, be sure to describe it. Then explain what factors influenced your decision and identify the trade-offs of your choice.

Hint: To write a complete answer, first state your opinion. Provide two or more pieces of evidence that support your opinion. Then consider all sides of the issue and identify the trade-offs of your decision.


4. **Reflection:** Would you rather be a scientist, an inventor, or a combination of the two? Why did you make this choice? Explain.

EXTENSION 1

Look up other people described in your science book and decide whether you would describe each person as more of a scientist, an inventor, or a combination of the two.



EXTENSION 2

 Look up other scientists and inventors working in a field that interests you. You can get started by searching on the internet or by looking in the science pages of newspapers and magazines.

Barbara McClintock (1902–1992)

Barbara McClintock studied how genes are transmitted from parent to offspring and made an unexpected discovery. She demonstrated that genes can move from one chromosome to another and that this can change the function of the gene. For many years, the scientific community did not realize the significance of her work. She received the Nobel Prize in Medicine in 1983.



Lloyd Hall (1884–1971)

Lloyd Hall was an African-American researcher who earned a Ph.D. in chemistry and was awarded over 100 patents. Many of the patents were issued for new preservatives that helped to prevent food from spoiling. His methods are still widely used today. After his retirement, he became a consultant to the Food and Agriculture Organization of the United Nations.

David Ho (1952–)

David Ho is the director of the Aaron Diamond AIDS Research Center in New York City. He is one of the pioneers who discovered how the virus is (and is not) transmitted. Ho is known for developing an approach that provides anti-AIDS drugs to people as soon as possible after they contract the virus, rather than waiting for symptoms to appear. In 1996 he was named *Time* magazine's Person of the Year.

**Helen Murray Free (1923–)**

During her long career as a research chemist with Miles Laboratories and Bayer, Inc., Helen Free has obtained several patents for her improvements in medical testing. For example, she developed the first home “dip and read” urine test that allowed diabetics to check their own blood sugar levels. In 1993, she served as President of the American Chemical Society. In 2000, she was inducted into the National Inventor's Hall of Fame.

Lydia Villa-Komaroff (1947–)

Lydia Villa-Komaroff was a member of the research team at MIT that demonstrated that bacterial cells can be used to produce insulin to treat people with diabetes. This was accomplished by inserting the human insulin gene into the DNA of the bacteria. This discovery helped launch recombinant DNA technology. Villa-Komaroff is a founding member of the Society for the Advancement of Chicanos and Native Americans in Science. In 2003, *Hispanic Business* magazine named her one of the 100 most influential Hispanics in America.



Edward O. Wilson (1929–)

Edward Wilson grew up in Alabama and went to college there. He is currently Emeritus Professor of Entomology—the study of insects—at Harvard. He is known for his controversial comparisons between ant behavior and human behavior. Currently he studies and writes about the diversity of life, suggesting that it is worth protecting not only for its usefulness to humans, but also for its own sake.



Nancy Wexler (1945–)

Nancy Wexler studies Huntington's disease. Most people with Huntington's disease first notice symptoms in their 30s or 40s. The brain cells of a person with this disease degenerate. Eventually the person dies, usually 10 to 20 years after symptoms appear. The disease is passed through genes from parent to child. To study the disease, Dr. Wexler found a large family in Venezuela in which there were many cases of Huntington's. For 20 years she studied this family. Finally, she and her team found the gene that causes the disease. She was able to develop a test to see if people who might inherit the Huntington's gene will actually get the disease. Now that the gene has been identified, scientists are searching for treatments and a cure.

J. Craig Venter (1946–)

J. Craig Venter is a pioneer in research on genes of a full range of species—from bacteria to humans. His research team contributed to the Human Genome Project, which sequenced the human genome. Dr. Venter is trying to produce the first completely human-made bacteria. He thinks that genetically engineered bacteria may one day solve many of today's problems. He predicts these bacteria will someday clean our air and produce alternative fuels. In 2007, *Time* magazine called him one of the world's 100 most influential people.



Charles Drew (1904–1950)

Charles Drew was a doctor and researcher who studied the properties of blood, especially plasma. He developed methods for storing plasma for long periods of time and invented blood banks and bloodmobiles. He directed the first Red Cross Blood Bank and became head of the department of surgery at Howard University and chief surgeon at Freedman's Hospital.

Bessie Blount (1914–?)

Bessie Blount was an African-American physical therapist who worked with patients who had been disabled during World War II. She invented devices that allowed patients who had lost their arms to eat independently. She received a patent for one of her devices in 1951, but was unable to convince the Veterans' Administration to use the device in its hospitals. Few details are known about her life, despite her initiative and useful work.

Jane Goodall (1934–)

Jane Goodall has spent most of her life collecting information about how chimpanzees live and interact. She conducted much of her research in the field, living for long periods of time on Gombe Stream in Tanzania. She founded the Jane Goodall Institute for Wildlife Research, Education, and Conservation, and she has published many articles and several books about chimp behavior.

**Wilson Greatbatch (1919–)**

Wilson Greatbatch invented the first cardiac pacemaker that could be implanted in patients. He was trained as an electrical engineer. He has patented many inventions, including a compact and long-lasting battery for pacemakers. In 1986, he was inducted into the National Inventors Hall of Fame. In 2001, he won the Russ Prize. Modeled after the Nobel Prize, it is awarded for outstanding achievement in engineering that improves human life.

Stephen Jay Gould (1941–2002)

Stephen Gould was a paleontologist and evolutionary biologist at Harvard University. He was one of the first to suggest that species evolve slowly until fairly rapid changes lead to the formation of new species. Though his own work focused on the evolution of land snails, he was the author of many books on a broad range of topics related to evolution. He wrote a monthly column in *Natural History* magazine for 30 years.



Lynn Margulis (1938–)

Lynn Margulis is a cell and microbial biologist who has researched the evolution of cells and cell organelles such as chloroplasts and mitochondria. She is well-known for the idea that these organelles in plant and animal cells evolved from simple cells similar to bacteria. She is a professor at the University of Massachusetts and has published numerous research papers and several books.

Dr. Bruce Alberts (1938–)

Bruce Alberts studies cell division. When cells divide, the chromosomes inside the cells replicate. For this to happen, certain proteins are needed. Alberts has spent most of his life studying these proteins and how they affect cell division. Another passion of his is working to improve science education. He works with teachers, scientists, and school systems to improve how science is taught. He was the president of the National Academy of Sciences from 1993 to 2005. Since 2007, he has been the editor of *Science*, a well-known science journal.



Elizabeth Blackburn (1948–)

Elizabeth Blackburn studies structures at the ends of chromosomes. These structures protect normal cells from aging. They also keep cancer cells from getting old and being destroyed. Dr. Blackburn also studies the enzyme that keeps these structures healthy. Currently, she is using her understanding of chromosomes to study cancer cells. In 2007, she and Dr. Joan Steitz became the first women to win the Albany Medical Center Prize in Medicine and Biomedical Research. *Time* magazine named her one of the 100 most influential people in the world in 2007.